CSCI/MATH 2113
DISCRETE STRUCTURES II
WINTER 2021 COURSE SYLLABUS

COURSE INFORMATION

Instructor:

- Neil Julien Ross
- Email: `neil.jr.ross@dal.ca`

Teaching assistant:

- Zhiyuan (Owen) Zhang
- Email: `owen.zhang@dal.ca`

Course homepage:

- Brightspace: CSCI 2113 & MATH 2113 – Discrete Structures II
- Microsoft Teams: CSCI/MATH 2113

Synchronous sessions:

- Topic coverage and problem solving sessions will be held online on Microsoft Teams Mondays, Wednesdays, and Fridays (13:35 – 14:25).
- To join the synchronous sessions: MS Teams → CSCI/MATH 2113 → Lectures.
- Attendance is highly recommended but not mandatory. Recordings will be made available.

Office hours and course support:

- Office hours will be held before class (12:35 – 13:25) on Wednesdays (Zhang) and Fridays (Ross).
- Further support is available through the math learning centre and the CS Learning Centre

IMPORTANT DATES

See: `https://www.dal.ca/academics/important_dates.html`.

COURSE DESCRIPTION

This class continues the exploration of discrete mathematics started in Discrete Structures I. It aims to further develop logical reasoning skills which are important to computer science and mathematics. Elementary counting techniques lead to sophisticated methods to approach combinatorial problems. These methods include bijective counting and discrete probability. Structures such as partitions, permutations, symmetry groups, graphs and trees are introduced. Finally, discrete principles are applied to computation, transmission, and correction of digital information.

Please note that all lectures and tutorials will be recorded and made available to the TAs and students enrolled in the course. This measure is taken to ensure that no matter the day to day internet availability or equipment availability

all students can access the course material. Participation in lectures and tutorials will automatically indicate that you consent to your voice, text or screen sharing being recorded for viewing by those enrolled in or assisting in the delivery of the course.

Prerequisites: CSCI/MATH 2112.03: Discrete Structures I.

TEXTBOOK

The textbook for this course is:

- *Discrete and Combinatorial Mathematics: An Applied Introduction* by Ralph P. Grimaldi.

Our goal is to cover chapters 5 – 13 of the book.

CLASS FORMAT & COURSE COMMUNICATION

Content will be delivered through live sessions, office hours, and assignments.

- Live sessions will take place on Microsoft Teams.
- Recordings from the live sessions will be available following the sessions. Students are encouraged to attend the synchronous sessions. However, attendance is not mandatory.
- Students must ask the instructor permission before recording any presentations. This is governed by the University's Classroom Recording protocol.
- Course announcements will be posted on Brightspace and on Teams. It is the student's responsibility to check Teams, Dalhousie email, and Brightspace regularly. To access your Dal email account please see: `https://www.dal.ca/dept/its/o365/ser-vices/email.html`.

LEARNING OUTCOMES

- Be able to count combinatorial objects using elementary techniques.
- Be able to read a description of a counting problem and derive a recurrence relation to solve the problem.
- Recognize common counting-related sequences such as Fibonacci numbers, Catalan numbers, and Stirling numbers.
- Be able to compose and manipulate generating functions, and use generating functions to obtain a direct formula for a recursively defined sequence.
- Understand discrete probability spaces and random variables. Be able to compute the expected value of a discrete random variable by expressing it as a sum of relevant indicator variables and using linearity of expectation.
- Be able to define and recognize partitions, permutations, groups, graphs and trees. Know the difference between labelled and unlabelled graphs and trees, and ordered and unordered trees.
- Be able to find the multiplicative subgroups of the integers modulo a given integer.
- Be able to define Shannon entropy and describe what it represents.
- Know the relationship between entropy and compressibility. Be able to find the optimally compressed representation of a random binary channel using Huffman codes.
- Know the basic concepts of error-correction in binary channels. Be able to encode and decode messages with a linear code. Be able to construct Hamming codes.
- Be able to distinguish between countable and uncountable sets. Know Cantor's diagonalization argument

EVALUATION CRITERIA

The grading scheme for the course is described in the table below.

GRADE ITEM	COUNT	EACH	TOTAL
Assignments	6 (best 5 out of 6)	10 %	50 %
Midterm	1	20 %	20 %
Final	1	30 %	30 %

The final grade is out of 100%. Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale.

Assignments: There will be 6 assignments throughout the term. In addition, there will be a "dummy" assignment whose purpose is to ensure that the assignment submission process functions smoothly. Solutions to the assignments will be posted on Brightspace after they are graded. The best 5 out of 6 assignments are counted. Support is available through office hours and through the CS Learning Centre.

Dates for the assignments are as follows.

- Assignment 0 (dummy): posted on January 6th, due on January 15th.
- Assignment 1: posted on January 15th, due on January 29th.
- Assignment 2: posted on January 29th, due on February 12th.
- Assignment 3: posted on February 12th, due on February 26th.
- Assignment 4: posted on February 26th, due on March 12th.
- Assignment 5: posted on March 12th, due on March 26th.
- Assignment 6: posted on March 26th, due on April 5th.

Assignments will be posted on Brightspace. Assignments must be submitted by the due date through Brightspace.

Assignments must be submitted as a single pdf, with each new question starting on a new page, and with the questions in the correct order. Incorrectly formatted submissions will be returned and points may be deducted.

Midterm: The midterm will take place on March 5th. Two start times will be available in order to accommodate students in different time zones. Once the midterm is started, it will be time-limited (2 hours). The midterm is worth 20%. It is to be done individually (no communication of any kind with classmates). Questions will be supported by both the instructor and the TA.

Final: The final exam will be a take home exam, similar to the assignments in style and difficulty. Students should be prepared to briefly meet online with their instructor to discuss the solutions to their final exam. The final exam will be sent to students individually. Students can choose the date during the exam period at which they wish to write their final exam. Students must complete their final exam within 48 hours of the start date. The submission protocol for the final exam is the same as for assignments.

Collaboration: Students are encouraged to collaborate with their peers when learning and reviewing topics. However, each student will need to submit their own work and must work independently on each of their assessments (quizzes, assignments, tests and final exam).

General policies:

- A minimum C grade is required in this course if it is core to your FCS degree, or if it will be used as a prerequisite for a subsequent CSCI course.
- As of 2019, students who receive a grade lower than C in the same required CS course twice, will be dismissed.
- A student must pass (50%) both the assignment component and the final exam to pass the course.
- There are no make-up assessments.
- Missed assessments will be counted as zero, unless prior permission is granted.
- It is up to the discretion of the instructor to use remote proctoring in online testing (tests and/or final exam). Students may be required to download proctoring software onto their devices. Students who cannot meet system requirements for remote proctoring should contact the instructor for an alternate assessment. (Typical system requirements are: (i) Mac OS or Windows, (ii) a web-cam, and (iii) an internet connection.)
- There is no retroactive accommodation. Students must notify in advance of any assessment deadline if they cannot attend the exam or practicum or are unable to submit the assignment. Valid reasons for accommodation are typically medical or family related. An alternate arrangement will then be agreed upon between the instructor and the student.
- A student must submit a Self-Declaration of Absence form if they are unable to write a test, a practicum, or submit an assignment due to illness or family emergency.
- Delays and problems related to technology failure will be addressed on a case-by-case basis.
- Unless stated otherwise, all work is to be done individually.
- Students are encouraged to review the marking of their work and to challenge it when appropriate. Grade changes, however, will only be granted if an issue is raised within 2 weeks of the posting of grades.
- As much as possible, and in order to foster a sense of community, questions about the course content should not be asked through email. Instead, these questions should be raised during office hours or posted on Brightspace (using the appropriate discussion boards).
- Student emails as well as questions posted on Brightspace discussion boards will be answered within 48 hours.

TENTATIVE SCHEDULE OF TOPICS

See the calendar posted on Brightspace.

RESPONSIBLE COMPUTING POLICY

Usage of all computing resources in the Faculty of Computer Science must be within the Dalhousie Acceptable Use Policies (`http://its.dal.ca/policies/`) and the Faculty of Computer Science Responsible Computing Policy. (`https://www.cs.dal.ca/downloads/fcs_policy_local.pdf`)

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CULTURE OF RESPECT

Every person has a right to respect and safety. We believe inclusiveness is fundamental to education and learning. Misogyny and other disrespectful behaviour in our classrooms, on our campus, on social media, and in our community is unacceptable. As a community, we must stand for equality and hold ourselves to a higher standard.

What we all need to do [1]:

1. **Be Ready to Act:** This starts with promising yourself to speak up to help prevent it from happening again. Whatever it takes, summon your courage to address the issue. Try to approach the issue with open-ended questions like "Why did you say that?" or "How did you develop that belief?"
2. **Identify the Behaviour:** Use reflective listening and avoid labeling, name-calling, or assigning blame to the person. Focus the conversation on the behaviour, not on the person. For example, "The comment you just made sounded racist, is that what you intended?" is a better approach than "You're a racist if you make comments like that."
3. **Appeal to Principles:** This can work well if the person is known to you, like a friend, sibling, or co-worker. For example, "I have always thought of you as a fair-minded person, so it shocks me when I hear you say something like that."
4. **Set Limits:** You cannot control another person's actions, but you can control what happens in your space. Do not be afraid to ask someone "Please do not tell racist jokes in my presence anymore" or state "This classroom is not a place where I allow homophobia to occur." After you have set that expectation, make sure you consistently maintain it.
5. **Find or be an Ally:** Seek out like-minded people that support your views, and help support others in their challenges. Leading by example can be a powerful way to inspire others to do the same.
6. **Be Vigilant:** Change can happen slowly, but do not let this deter you. Stay prepared, keep speaking up, and do not let yourself be silenced.

UNIVERSITY STATEMENTS

This course is governed by the academic rules and regulations set forth in the University Calendar and the Senate. See the relevant section in the academic calendar.

Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity.
`http://www.dal.ca/dept/university_secretariat/academic-integrity.html`

Accessibility

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of: a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (NS, NB, PEI, NFLD).
`http://www.dal.ca/campus_life/student_services/academic-support/accessibility.html`

Student Absence Declaration

In January 2018, the Student Declaration of Absence Form was introduced in select courses to re-place sick notes for absences of three days or fewer that result in missed or late academic require-ments.

[1] Source: Speak Up! ©2005 Southern Poverty Law Center. First Printing. This publication was produced by Teaching Tolerance, a project of the Southern Poverty Law Center. Full "Speak Up" document found at: `http://www.dal.ca/dept/dalrespect.html` Revised by Susan Holmes from a document provided April 2015 by Lyndsay Anderson, Manager, Student Dispute Resolution, Dalhousie University 902.494.4140 `lyndsay.anderson@dal.ca www.dal.ca/think`.

https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/academic-policies/student-absence.html

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution.

https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/student-life-policies/code-of-student-conduct.html

Diversity and Inclusion —- Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness (Strategic Priority 5.2).

http://www.dal.ca/cultureofrespect.html

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit the office in the McCain Building (room 3037) or contact the programs at elders@dal.ca or 902-494-6803 (leave a message).

Learning and Support Resources

- General Academic Support — Advising
- Fair Dealing Guidelines
- Dalhousie University Library